

Message Text

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PAGE 01 STATE 180368

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ORIGIN ERDA-07

INFO OCT-01 EUR-12 ISO-00 OES-06 /026 R

DRAFTED BY USERDA:ENCDALDER
APPROVED BY DBHOYLE:OES/NET/IM
USERDA:EEKINTNER
EUR/RPE:DSWARTZ
OES/SCI/SEP (INFO)
EUR/RE:GWOLFE

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P 211857Z JUL 76
FM SECSTATE WASHDC
TO AMEMBASSY MOSCOW PRIORITY

UNCLAS STATE 180368

FOR SCICOUN

E.O. 11652: N/A

TAGS: US,UR,TECH,TGEN,ENRG

SUBJECT:CONTROLLED THERMONUCLEAR RESEARCH 07.03.00

1. REQUEST EMBASSY DELIVER FOLLOWING MESSAGE TO ORGANIZING COMMITTEE OF THE SEMINAR ON THE APPLIED PROBLEMS OF LOW TEMPERATURE MATERIALS AND THE MANUFACTURE OF WELDED CRYOGENIC STRUCTURE:

E.O. PATON WELDING INSTITUTE
BOZHENKO 11
KIEVE 5, U.S.S.R.

2. GENTLEMEN:
DR. E.N.C. DALDER OF THE DIVISION OF MAGNETIC FUSION ENERGY, US ERDA, GRATEFULLY ACCEPTS YOUR INVITATION TO PARTICIPATE IN THE SUBJECT SEMINAR AND THE ASSOCIATED USSR-US COOPERATION ON ELECTROMETALLURGY. HE WILL PRESENT A PAPER ENTITLED "STRUCTURAL MATERIALS, DESIGN CRITERIA AND FABRICATION METHODS FOR SUPERCONDUCTING ENERGY STORAGE UNCLASSIFIED

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SYSTEMS; A STATUS REPORT". A COPY OF AN ABSTRACT OF THE

PAPER FOLLOWS.

3. THANK YOU FOR YOUR INVITATION.

- - - - - CORDIALLY YOURS,

STRUCTURAL MATERIALS, DESIGN CRITERIA, AND
FABRICATION METHODS FOR SUPERCONDUCTING ENERGY STORAGE
SYSTEMS; A STATUS REPORT

EDWARD N.C. DALDER

DIVISION OF MAGNETIC FUSION ENERGY

U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION,
WASHINGTON, D.C. 20545

UNITED STATES OF AMERICA

ABSTRACT

THIS PAPER ADDRESSES THE RELATED AREAS OF SELECTION,
DEVELOPMENT AND FABRICATION OF STRUCTURAL MATERIALS FOR
LARGE SUPERCONDUCTING MAGNETIC ENERGY STORAGE SYSTEMS FOR
USE IN THE MAGNETIC FUSION ENERGY-;MFE-- PROGRAM OF THE
U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION.

A REVIEW OF THE MFE NEEDS FOR SUPERCONDUCTING MAGNET
STRUCTURES IS PRESENTED TOGETHER WITH AN EXTENSIVE ANALY-
SIS OF STRUCTURAL DESIGN CRITERIA. FOLLOWING THIS, A
REVIEW OF AVAILABLE STRUCTURAL ALLOYS SUCH AS THE SIMPLE
AUSTENITIC STAINLESS STEELS, NITROGEN-STRENGTHENED
STAINLESS STEELS, SOLID SOLUTION STRENGTHENED NI-CR-FE
ALLOYS, PRECIPITATED-STRENGTHENED NI-CR-FE ALLOYS,
ALUMINUM ALLOYS, AND HIGH PURITY TITANIUM ALLOYS IS
PRESENTED. AVAILABLE MATERIALS-PROPERTY DATA IN THESE
ALLOY CLASSES ARE COMPARED, WITH EMPHASIS ON THE EFFECTS
OF LOW TEMPERATURE ON ELASTIC MODULUS AND YIELD STRENGTH,
FATIGUE PERFORMANCE, AND VARIOUS FRACTURE-CONTROL
CRITERIA, SUCH AS PLANE-STRAIN FRACTURE-TOUGHNESS, AND
CRACK-GROWTH RATE. CONCLUSIONS ARE DRAWN RELATIVE TO THE
NEED FOR ADDITIONAL DATA-GENERATION AND THE MOST PROMIS-
ING MATERIAL-CLASSES FOR FURTHER INVESTIGATION.

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THE IMPORTANT AREAS OF FABRICATION OF THESE MATERIAL
CLASSES ARE REVIEWED. SUCH JOINING-RELATED PROBLEMS AS
WELDING OF HEAVY SECTION COMPONENTS, CONTROL OF
FERROMAGNETIC PHASES IN AUSTENITIC STAINLESS STEEL
WELDMENTS TO MINIMIZE MAGNETIC FIELD PERTURBATIONS,
OPTIMIZATION OF WELDING PRACTICE TO AVOID EMBRITTLEMENT
PROBLEMS COMMON TO NI-CR-FE ALLOYS, SUCH AS HOT CRACKING
AND STRAIN AGE CRACKING, AND THOSE COMMON TO TITANIUM

ALLOYS, SUCH AS HYDROGEN EMBRITTLEMENT, ARE DISCUSSED IN DETAIL. ALSO TREATED IS THE EFFECT OF PRIMARY PROCESSING TECHNIQUES, SUCH AS AIR-MELTING, ELECTROSLAG REMELTING, AND VARIOUS VACUUM MELTING PROCEDURES, ON THE RESULTING MECHANICAL AND METALLURGICAL PERFORMANCE OF NI-CR-FE AND TI ALLOYS. THE FINAL TOPIC TO BE PRESENTED IS A DISCUSSION OF CURRENT PLANS FOR SUPER-CONDUCTING MAGNETIC-ENERGY STORAGE SYSTEMS, IN LIGHT OF PREVIOUSLY IDENTIFIED NEEDS AND THE PRESENT STATUS OF MATERIALS AND FABRICATION METHODS. KISSINGER

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Message Attributes

Automatic Decaptoning: X
Capture Date: 01 JAN 1994
Channel Indicators: n/a
Current Classification: UNCLASSIFIED
Concepts: GEOTHERMAL ENERGY, PUBLIC CORRESPONDENCE, NUCLEAR RESEARCH, NUCLEAR REACTORS, MEETING DELEGATIONS
Control Number: n/a
Copy: SINGLE
Draft Date: 21 JUL 1976
Decaption Date: 01 JAN 1960
Decaption Note:
Disposition Action: n/a
Disposition Approved on Date:
Disposition Authority: n/a
Disposition Case Number: n/a
Disposition Comment:
Disposition Date: 01 JAN 1960
Disposition Event:
Disposition History: n/a
Disposition Reason:
Disposition Remarks:
Document Number: 1976STATE180368
Document Source: CORE
Document Unique ID: 00
Drafter: ENCDALDER
Enclosure: n/a
Executive Order: N/A
Errors: N/A
Film Number: D760281-0057
From: STATE
Handling Restrictions: n/a
Image Path:
ISecure: 1
Legacy Key: link1976/newtext/t19760735/aaaabeub.tel
Line Count: 128
Locator: TEXT ON-LINE, ON MICROFILM
Office: ORIGIN ERDA
Original Classification: UNCLASSIFIED
Original Handling Restrictions: n/a
Original Previous Classification: n/a
Original Previous Handling Restrictions: n/a
Page Count: 3
Previous Channel Indicators: n/a
Previous Classification: n/a
Previous Handling Restrictions: n/a
Reference: n/a
Review Action: RELEASED, APPROVED
Review Authority: hackerp0
Review Comment: n/a
Review Content Flags:
Review Date: 16 MAR 2004
Review Event:
Review Exemptions: n/a
Review History: RELEASED <16 MAR 2004 by ThomasVJ>; APPROVED <06 JAN 2005 by hackerp0>
Review Markings:

Margaret P. Grafeld
Declassified/Released
US Department of State
EO Systematic Review
04 MAY 2006

Review Media Identifier:
Review Referrals: n/a
Review Release Date: n/a
Review Release Event: n/a
Review Transfer Date:
Review Withdrawn Fields: n/a
Secure: OPEN
Status: NATIVE
Subject: ONTROLLED THERMONUCLEAR RESEARCH 07.03.00
TAGS: TECH, TGEN, ENRG, US, UR, (DALDER, E N C)
To: MOSCOW
Type: TE
Markings: Margaret P. Grafeld Declassified/Released US Department of State EO Systematic Review 04 MAY 2006